Chapter 1
Block Designs

The theory of discrete designs is intimately related to many other topics of combinatorial theory. The principles of experimental designs were formulated by Sir Ronald A. Fisher in his famous book 'Statistical Methods for Research Workers' (1925) and in his paper 'The arrangement of field experiments' (1926). The design of such statistical experiments often used combinatorial structures that yielded simple calculation of estimates and/or variances often leading to optimality properties. One of the typical examples is a block design with some balancing. The family of block designs is of importance in statistical designs because of its appealing properties in both the combinatorial and the statistical sense. In fact, block designs have opened up many interesting and challenging problems in combinatorial mathematics since 1844 (Woolhouse), 1847 (Kirkman) and 1853 (Steiner).

The present chapter consists of three papers. Two of the papers are mainly expository and are concerned with combinatorial properties of block designs and the construction of block designs. The third paper is concerned with the characterization of combinatorial structures such as weighing matrices.